

CHAPTER 3

Drafting Conventions

OBJECTIVE

- This chapter discusses line types, symbols, letters, and notes found on architectural drawings.

KEY TERMS

border lines	hidden object lines	note
center line	ID label	plan north
construction lines	leader line	poché
cutting plane	lettering	rendering
cylindrical break line	line	section lining
dimension lines	line quality	section symbols
elevation symbols	line type	short break line
enlargement box	line weight	title blocks
extension lines	local note	visible object lines
general note	long break line	
grid system	match lines	

Drafting involves breaking down complex, difficult ideas into simple, representational lines (see Figure 3-1). This process parallels the way our brains interpret and simplify the huge amount of visual information our eyes receive. A drafter's goal is to make a drawing as readable as a book to people trained in interpreting drawings. These people have different backgrounds; they include designers, contractors, subcontractors, owners, vendors, lenders and others. Making drawings readable to members of these groups is facilitated by following industry conventions and standards, the most common being the Uniform Drawing System (UDS) devised jointly by the American Institute of Architects and the Construction Specifications Institute (see Figure 3-20). However, these conventions can only be discussed at a general level, because each company has its own set of drafting standards. A protocol you learn in one office may be different in another. However, such protocols are never so different that you would not be able to infer what a differently-drafted label or symbol means as long as you understand the label or symbol in the first place.

Whenever you begin a new job, study drawings of the office's past projects to learn that office's specific conventions. Companies often provide a handbook of drafting graphic standards for their designers to follow.

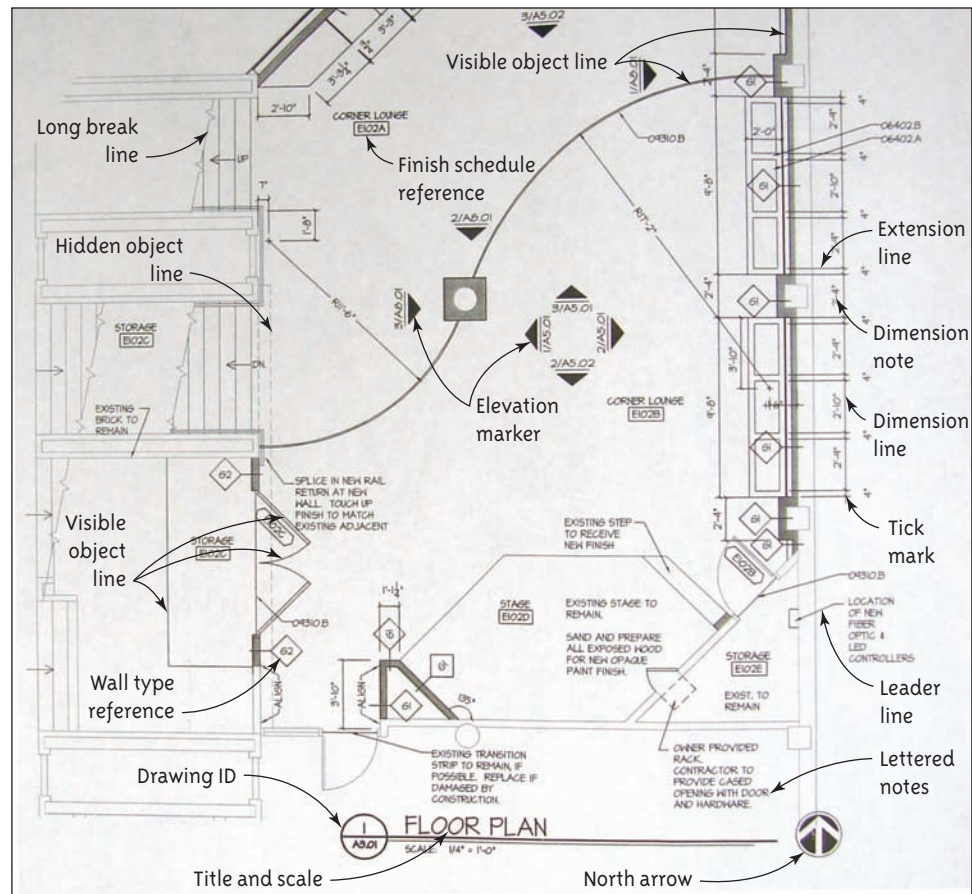


Figure 3-1
A hand-drawn floor plan of a campus building at Johnson County Community College, Overland Park, KS. Drawing courtesy of PGAV Architects, Westwood, KS.

The Line

The **line** is the fundamental tool of graphic communication. Different line weights (thicknesses) and line types communicate different ideas. Each line means something, so lines should never be randomly drawn. Because construction drawings are abstract, you should use as few lines as possible to describe an object.

A line is a thin (relative to its length), geometric object. It can also be thought of as an extended point. A line can be long, short, straight, curved, hard, freehand, horizontal, vertical, diagonal, thick, thin, or patterned.

Line Quality

Excellent **line quality** is critical. Each line must be drawn well. With the exception of construction lines, all lines are the color black. Lines should be of a consistent width from end to end and should be the proper width for their importance in the drawing. They should look clear, strong, and dark, and be drawn continuously from one end to the other, rather than as a series of short, overlapped pieces. Light, fuzzy, smudgy, or half-erased lines are weak and won't copy well. All lines must be joined at corners, never falling short; some offices prefer corner lines to overlap. Make a test copy of each drawing before using it for its intended purpose, as a copy will show weak lines more clearly than will the original media.

Line Weight

Line weight (also called hierarchy) refers to thickness. Thicker lines engage the reader's eye first; therefore features that should be read first are drawn with more prominent lines. This practice evolved because most people can interpret a drawing with multiple line thicknesses more easily than a drawing with just one line (see Figure 3-2). Line hierarchy helps clarify questions such as where the edge of a curved object is; which lines are structural and which are textural; and what distinguishes the hardness of a wall from the softness of fabric (Figure 3-2). Illustrators spend their careers addressing these questions and improving their drawings' readability by adjusting line weights and colors.

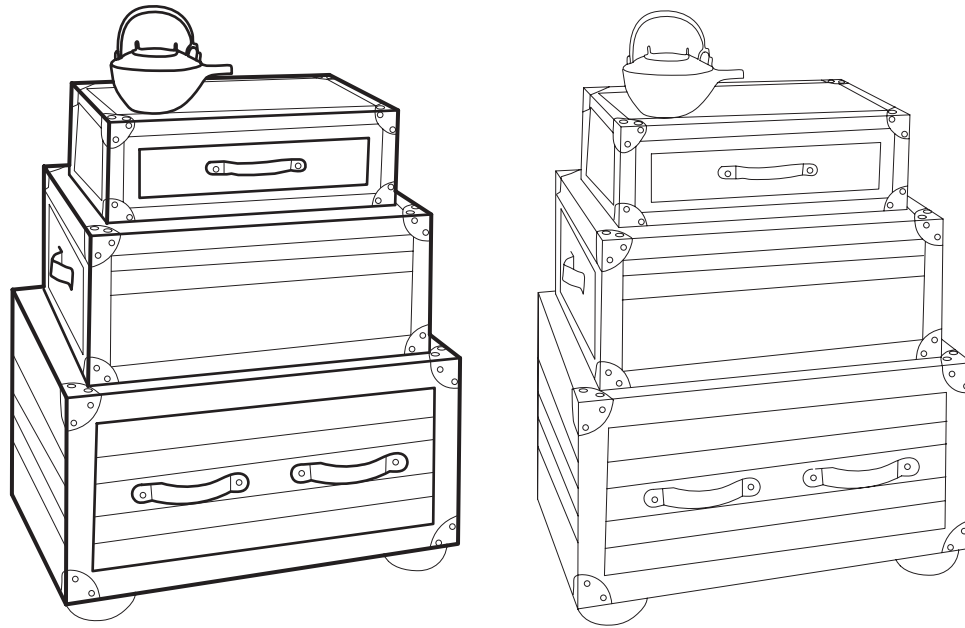


Figure 3-2
Differing line weights direct the eye to a drawing's prominent features first, making it easier to read.

Line Type

Line type (also called the alphabet of lines) is a pattern that a line takes to represent a specific concept. Different types mean different things. Following is a list of architectural line types and suggested pen sizes.

Visible Object Visible object lines define a physical item's outline. Walls, doors, porches, patios, cabinet edges, and floor tiles are examples of things represented with visible object lines. (Lines that represent appliances, toilets, and sinks are sometimes called fixture lines.) Object lines visible in the viewing plane are drawn with a continuous (nonpatterned) line.

Object lines have a hierarchy of relative weight. For instance, walls are thicker than doors and doors are thicker than their swings (Figure 3-3). So if walls are drawn with a 0.6 mm pen, doors might be drawn with a 0.5 mm pen, and arcs with a 0.3 mm pen. If walls are drawn with a 0.5 mm pen, doors might be drawn with a 0.35 mm pen, and arcs with a 0.25 mm one. Line weight also varies with the drawing scale. Larger scale drawings need thicker lines.

Although lines drawn with hard leads look thinner than leads drawn with soft leads, you can assume that a 0.5 mm drafting pencil will draw a 0.5 mm line. When using a drafting pencil, vary line weights by selecting different sizes (e.g., 0.3 mm for the thinnest lines and 0.9 for the thickest). When using the larger 2 mm drafting pencil, vary line weights by beveling one

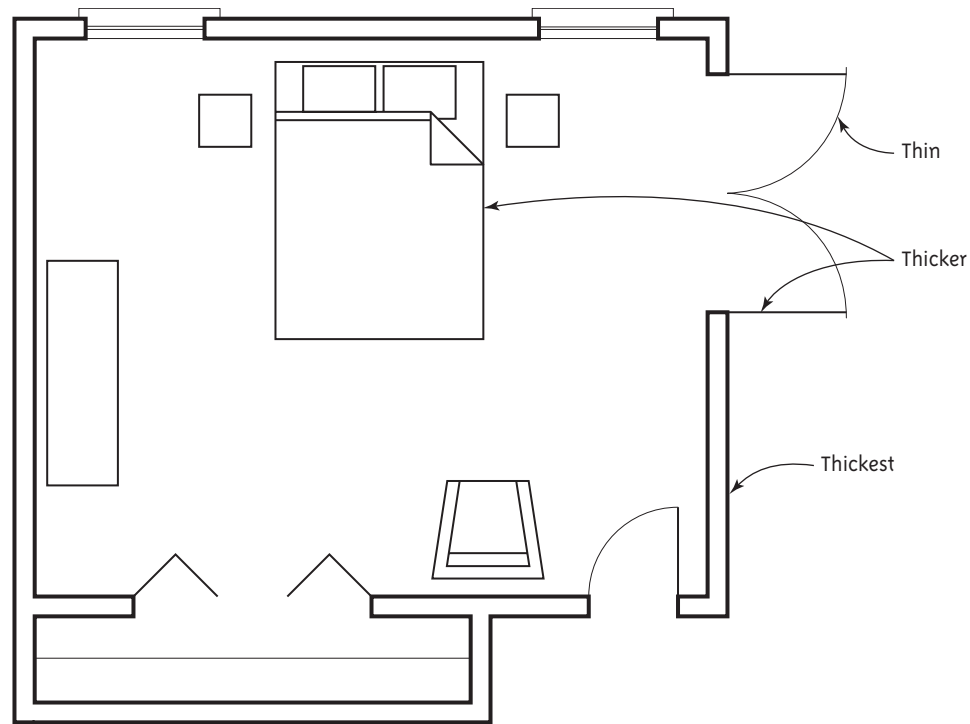


Figure 3-3
Line weights differ for the walls, doors, arcs, and furniture.

side of the lead on a sandpaper block and rotating the point as you draw. When inking, vary line weights by choosing different size pen tips. Avoid drawing over one line multiple times to widen it, as this often results in poor line quality. Recommended pen: 0.25–0.70 mm.

Hidden Object Hidden object lines define an item that is not visible in the reader’s current view but needs to be acknowledged anyhow (see Figure 3-4a). For instance, floor plans show features below a horizontal **cutting plane** four feet above the floor. Features above the four-foot level, such as wall-hung cabinets, are shown with a hidden line. Hidden lines may also show items destined for removal, such as in a demolition plan. Draw hidden lines short and evenly sized ($1/8''$ – $3/8''$ long), with shorter, evenly spaced distances ($1/16''$ – $1/8''$) between them. Some drafters draw hidden lines using different lengths depending on the lines’ importance. For example, an overhead beam might be drawn with a longer hidden line than a high closet shelf.

Hidden lines should touch each other at corners and touch any solid lines they intersect, begin or end at (Figure 3-4b). The reason hidden lines must touch solid lines is because when they don’t, the drawing describes something else or simply shows poor draftsmanship. Figure 3-5 is a drawing of a cylinder. The left image shows the hidden and visible lines touching; this describes a cylinder open on both ends. The right image, with its gap between the hidden and visible lines, may be poor drafting, or may be describing a “blind hole,” which is a hollow cylinder sealed at both ends. Recommended pen: 0.25 mm.

Figure 3-4a
Hidden lines represent features that cannot be seen in the view.

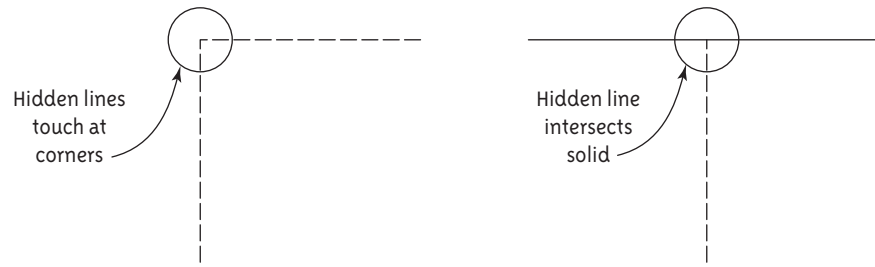


Figure 3-4b
Proper intersection of hidden and solid lines.

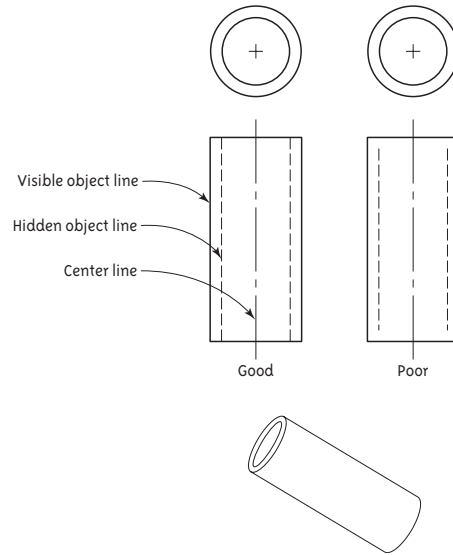


Figure 3-5
Proper termination of hidden lines in a drawing of an open hole.

C

Center A **center line** is drawn through the center of a feature (Figure 3-6). The notation “CL” is sometimes placed at one end. Recommended pen: 0.25–0.35 mm.

Long break A **long break line** is used to end a feature when drawing it in its entirety is not necessary (Figure 3-7). The long break is used after the feature’s defining characteristics have been shown. It can be drawn vertically or diagonally, with a sharp or smooth jag. Recommended pen: 0.25–0.35 mm.

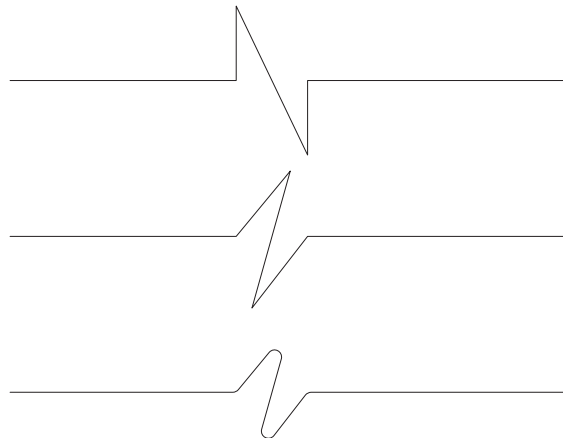


Figure 3-7
Long break lines.

Figure 3-6
Center line. The CL notation at the top is optional.

Short break The **short break line** serves the same purpose as the long break (Figure 3-8). It is not used as commonly as the long break. Recommended pen: 0.50 mm.

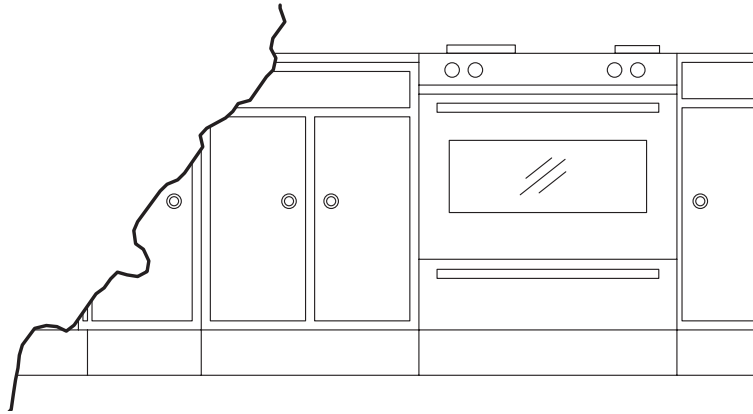


Figure 3-8
Short break line.

Cylindrical break Also called an s-break, the **cylindrical break line** is a freehand line placed through a cylindrical object such as a pipe or a column (Figure 3-9). It is more common in engineering drawings than in architectural drawings. Recommended pen: 0.35 mm.

Cutting plane The **cutting plane line** is drawn on the floor plan and shows where an object is sliced to create a section view (Figure 3-10). When it is drawn through the entire plan and has arrows placed at both ends, it indicates a section drawing. When it is drawn through a small portion of the plan and has just one arrow, it indicates a detail drawing. Either of the line types shown in Figure 3-10 may be used. Sometimes only the two ends of a cutting plane line are shown to avoid obscuring other lines on the plan. Recommended pen: 0.50–0.80 mm.

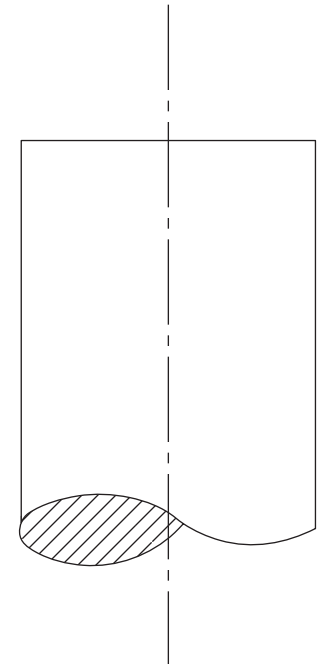


Figure 3-9
Cylindrical “s” break line.

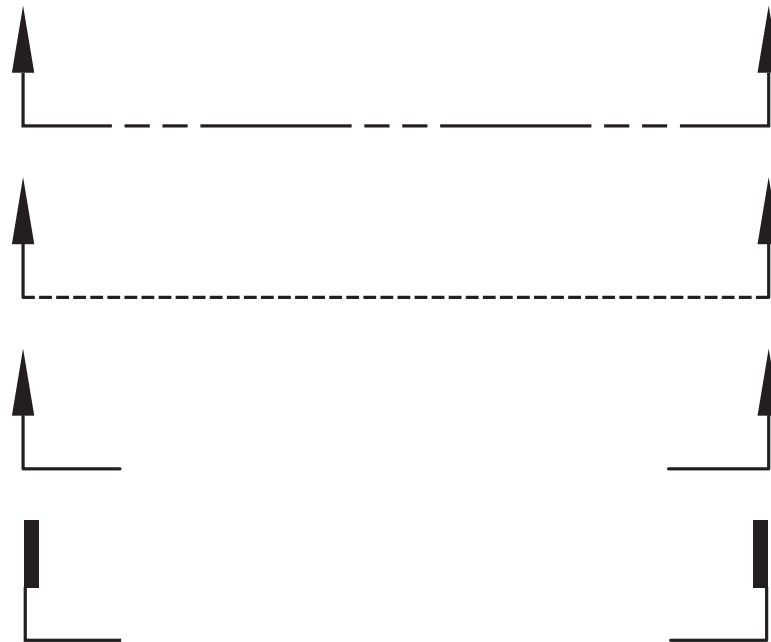


Figure 3-10
Different styles of cutting plane (section) lines and arrowheads. Arrowheads are opaque and three times as long as they are wide.

Section Lines Also called hatching, **section lines** are angled line patterns that indicate an object has been sliced (Figure 3-11). Forty-five degrees is a commonly used angle. Never draw section lines parallel or perpendicular to object lines. Spacing between section lines should be consistent. Recommended pen: 0.18–0.25 mm.

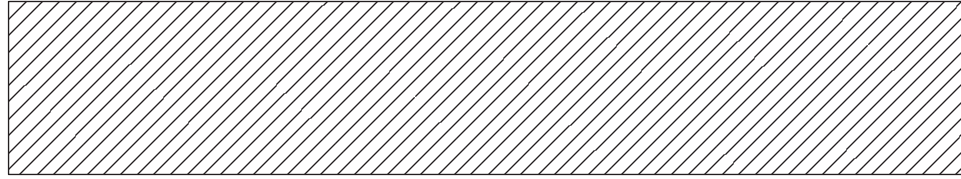


Figure 3-11
Section lines, also called hatching, are angled lines that represent where a material has been cut.

Poché Pronounced “po-shay,” **poché** is a French word for a repetitive, textural pattern used to describe the material of which an object is made (Figure 3-12). Poché is different from **rendering**, which is decorative detail on an object. Dozens of pochés are discussed in Chapter 8. Figure 3-12 shows three. Recommended pen: 0.25 mm.

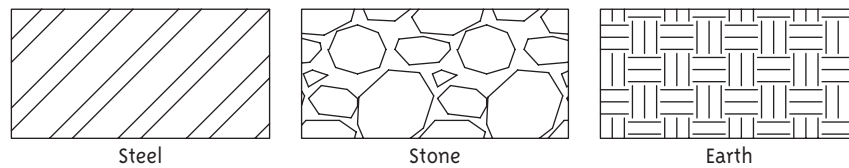


Figure 3-12
Poché symbols.

Match **Match lines** show where to align a large drawing that spans two or more sheets of paper (Figure 3-13). Match lines on a reduced-size floor plan show where the plan is continued on other sheets. Like hidden lines, they are dashed, but match lines are thicker and longer. Recommended pen: 0.50–0.80 mm.



Figure 3-13
Match line.

Border **Border lines** are thick lines that go around the perimeter of a sheet (Figure 3-14). They also can be used to underline titles. Recommended pen: 0.70–2.00 mm.



Figure 3-14
Border line.

Extension and Dimension **Extension lines** can emanate from the endpoints or center of an object (Figure 3-15). **Dimension lines** run perpendicular to them and contain the dimension note. These lines should be dark enough to reproduce on a copy, but thinner than the object lines so as not to be confused with them. On a pencil drawing, choose a hard (light) pencil or a dark, but thinner, pencil (or pen). Recommended pen: 0.25 mm.

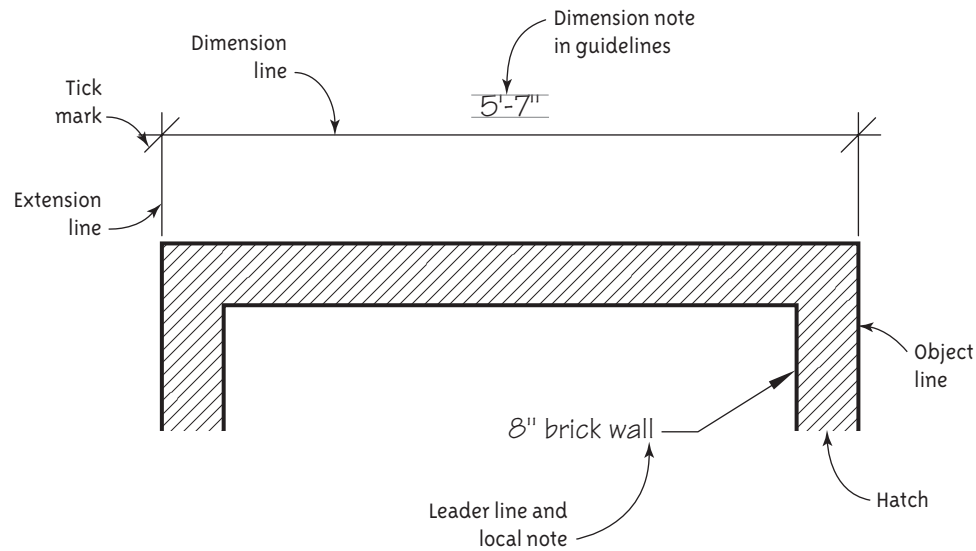


Figure 3-15
Extension, dimension, leader, and hatch lines.

Leader A **leader line** has an arrow or slash mark at one end and a **local note** at the other end, which describes the feature the leader line points to. A local note differs from a **general note**, which is placed elsewhere on the sheet and applies to everything on the sheet. Recommended pen: 0.25 mm.

Construction Also called projection lines, layout lines, or guide lines, **construction lines** are thin lines that help create object lines but are not part of the object itself. They may help position a drawing, regulate letter height, or project features from one picture plane to another. They are drawn lightly so they will reproduce very lightly (or not at all) on a copy. A 4H lead is used. These lines are not inked.

Symbols

Drawings contain symbols whose purpose is to identify specific features and concepts and reference those features to other drawings. Different construction disciplines (e.g., mechanical and electrical) have their own symbol sets, which are discussed in later chapters. The following are common symbols found on architectural drawings.

Section and Elevation Symbols

Section symbols and **elevation symbols**, sometimes referred to as call-outs, are symbols that indicate where, exactly, on the floor plan a section or elevation drawing is made.

Figure 3-16 contains both a section symbol and an elevation symbol.

The section symbol in Figure 3-17 consists of a circle, a line that cuts through the door opening, and numbers and letters. The reader is told that the drawing is drawing 6 on sheet A6.2. (*A* refers to architectural, *6* is the group number, and *2* refers to the group.) The arrow points in the direction of the cut; the material behind the arrow is ignored; and the material in front of the arrow is the subject of the drawing. The elevation symbol does not have a cut line because an elevation is not a cut drawing. Instead, it is a view of the object as seen from the front. The elevation drawing referenced by this symbol is drawing 5 on sheet A6.2.

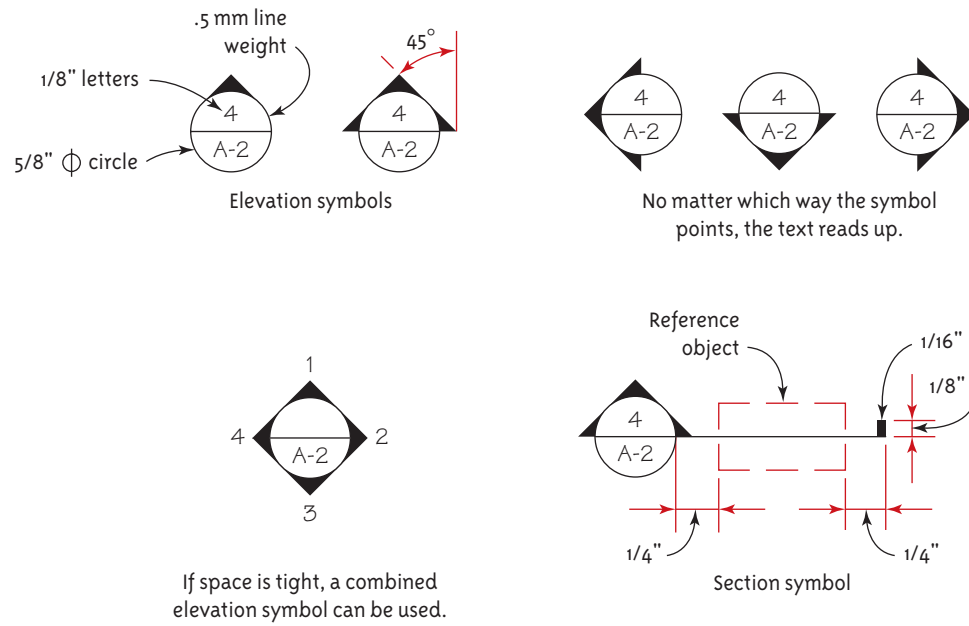


Figure 3-16
Proper orientation of lettering inside section and elevation symbols.

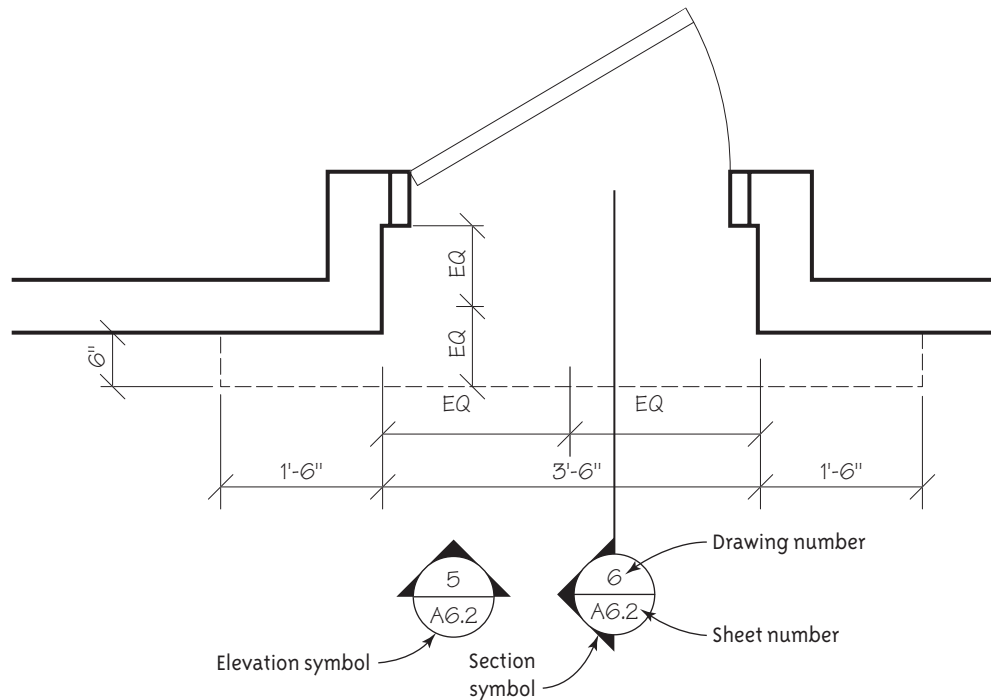


Figure 3-17
Section and elevation markers. In the section view the reader looks to the left. In the elevation, the reader looks up, toward the door.

Some elevation and section symbols include an additional number for cross-referencing. Note that the two-sided section symbol in Figure 3-18 has two numbers on its bottom. The first, A-2, states what sheet the section symbol is on. The second, A-3, states what sheet the section drawing referenced by the cut is on. The number 4 refers to which drawing on sheet A-3 the section refers to.

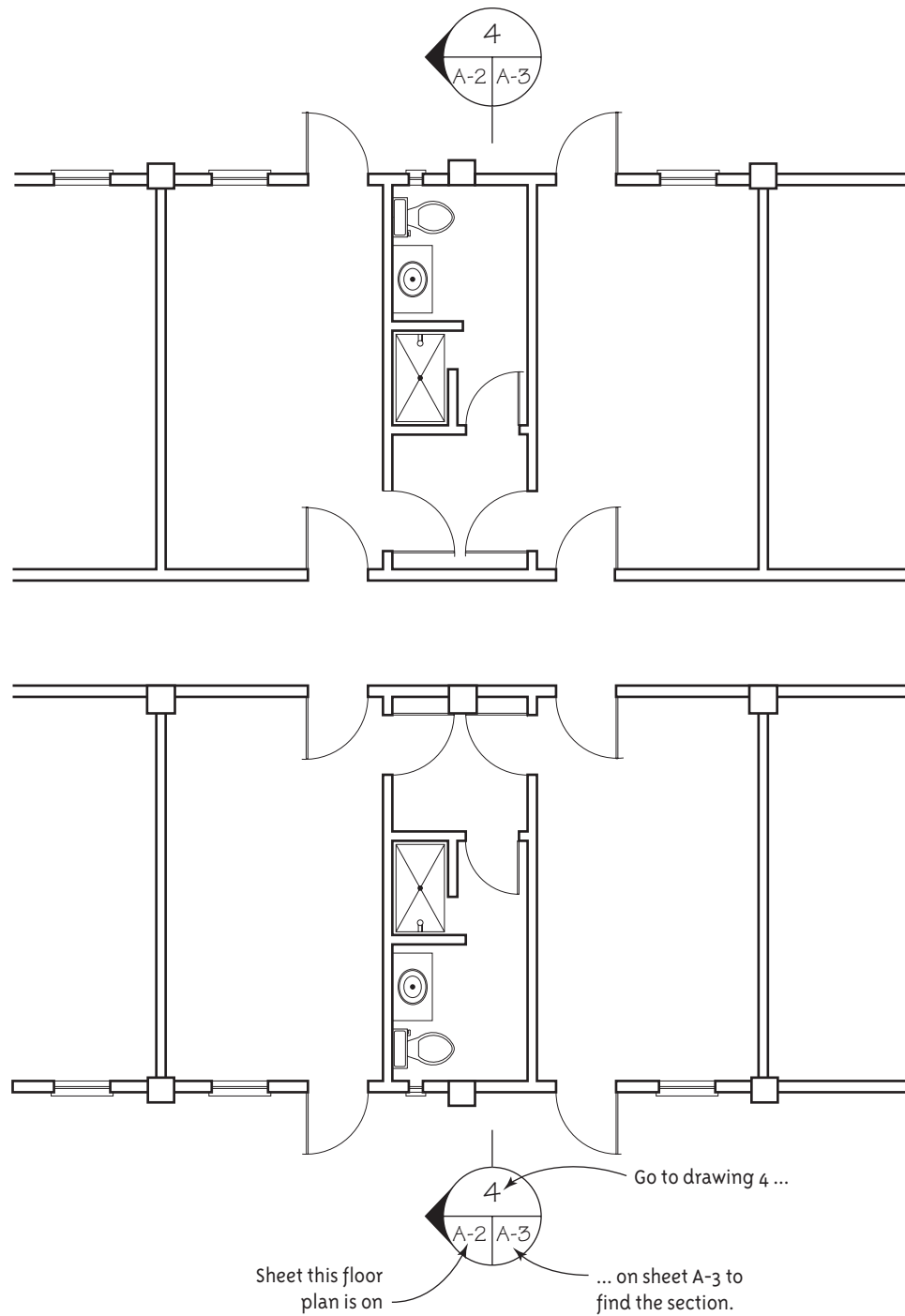


Figure 3-18
Cross-referenced section symbol.

ID Label

This goes under each drawing. Every figure on a sheet, whether it is a plan, section, or schedule, needs an identifier. It usually consists of a 3/4" diameter circle with an attached horizontal line. The drawing and sheet numbers are in the circle, the title is above the line, and the scale is below it. The circle is usually placed to the line's left. Office and regional practices vary; you may find that some drawing sets place it on the right on floor plans and on the left on all other drawings. Figure 3-19 shows the ID label on the section drawing that is referenced in Figure 3-18. Identical notation is found on the section drawing's **ID label**.

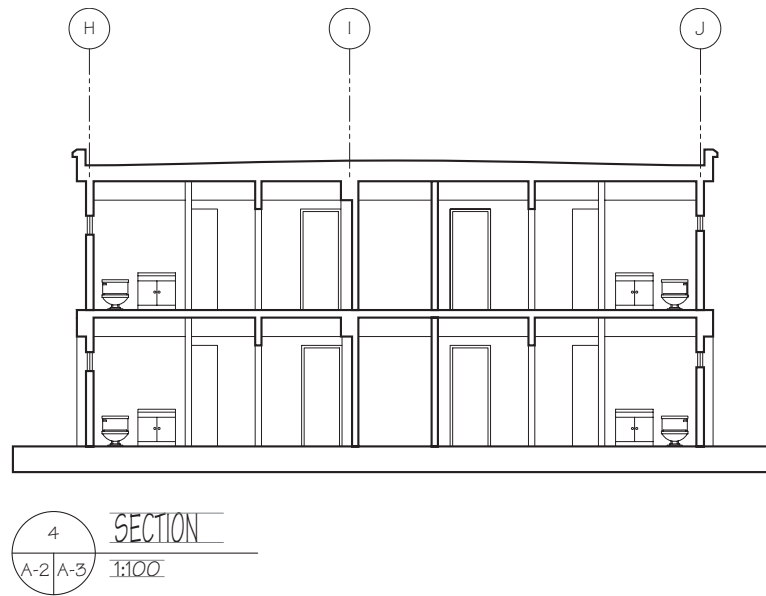


Figure 3-19
An ID label under the section referenced in Figure 3-18.

Miscellaneous IDs

Finishes, wall types, and the structural grid are identified by placing a name and/or number inside a shape. Ovals, rectangles, and circles are the most common shapes used for this purpose. These IDs usually reference a feature to a schedule. Any other repeating feature that the designer needs to call out is likewise assigned a symbol.

Enlargement Box

An area where a close-up is needed is encircled by heavy dashed lines (called an **enlargement box**) and has an attached ID label (see Figure 3-20). The label states where to find the close-up. The close-up should be drawn with the same orientation as it has on the plan.

Grid System

Drawings are laid out on a structural **grid system** that shows the location of columns, load-bearing walls, and other structural elements. **Grid lines** are used mostly for reference to schedules and for dimensioning. Vertical markers are numbered from left to right and horizontal markers, which are placed on the drawing's right, are numbered from bottom to top.

Sheet and Drawing Organization

Identification

Sheets and drawings must be labeled in a manner that makes their content and referencing clear. The American Institute of Architects (AIA) and Construction Specifications Institute (CSI) have developed protocols for this. Figure 3-21 shows the AIA's system, which is used by most architects.

Figures 3-22a and 3-22b show the Uniform Drawing System (UDS), which was developed by the CSI. It is more elaborate than the AIA's and is often used for large, complex construction and public works projects. It consists of a four-part identifier: a discipline designator, hyphen, group number and sheet number. The discipline designator identifies the type of drawings

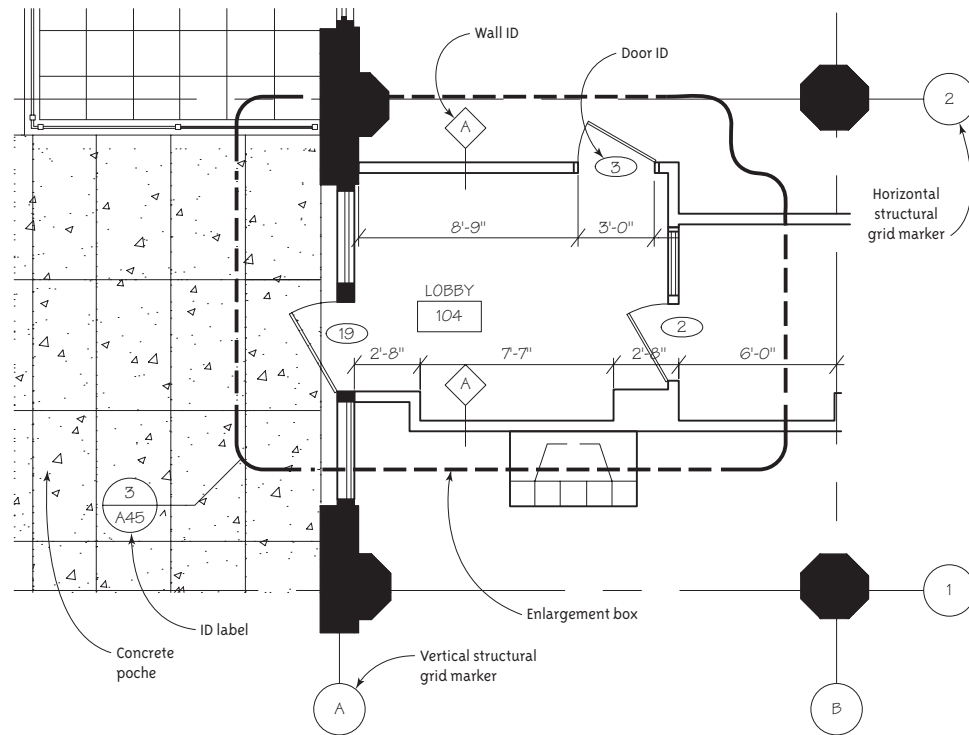


Figure 3-20
Enlargement box.

found on the sheet. The group number describes a specific type of drawing within the discipline. The sequence number states the sheet's number within the set. The group number will always be the same, no matter how many drawings are in the group.

This enables drawings to be added or removed without disrupting the set's alphanumeric order.

For less complex projects, only the discipline designator and sheet number may be used. Also, although the discipline designator always comes first, the order of the other elements may be slightly different, as shown in Figure 3-23.

A Architectural (plans, elevations, sections, details)	K Dietary (food service)
C Civil (roads, water, sewage removal, foundations)	L Landscape (site work, drainage, ground contouring, planting)
D Interior design (furniture, color schemes)	M Mechanical (heating, ventilation, air conditioning)
E Electrical (lighting, wiring, phone, security systems)	P Plumbing (pipes, fixtures)
F Fire protection (sprinklers, standpipes)	S Structural (framing, load transfer systems)
G Graphics (signage)	T Transportation/conveyance systems

Figure 3-21
AIA discipline designators.

G General	S Structural	M Mechanical
H Hazardous materials	A Architectural	E Electrical
V Survey/mapping	I Interiors	T Telecommunications
B Geotechnical	Q Equipment	R Resource
W Civil works	F Fire protection	X Other disciplines
C Civil	P Plumbing	Z Contractor/shop drawings
L Landscape	D Process	O Operations

Figure 3-22a
UDS coding designators.

0 General	5 Details
1 Plans	6 Schedules and diagrams
2 Elevations	7 User-defined
3 Sections	8 User-defined
4 Large-scale views	9 3-D pictorials

Figure 3-22b
UDS group designators.

Sheet Size

Identification labels, title blocks, dimensions, north arrows, schedules, specifications notes, and room for future users to add their own notes on the **as-builts** (printed sets that have handwritten notes on them acknowledging field changes) add to the size requirements of a drawing. This must be factored into sheet size and layout. All sheets in a set should be the same size.

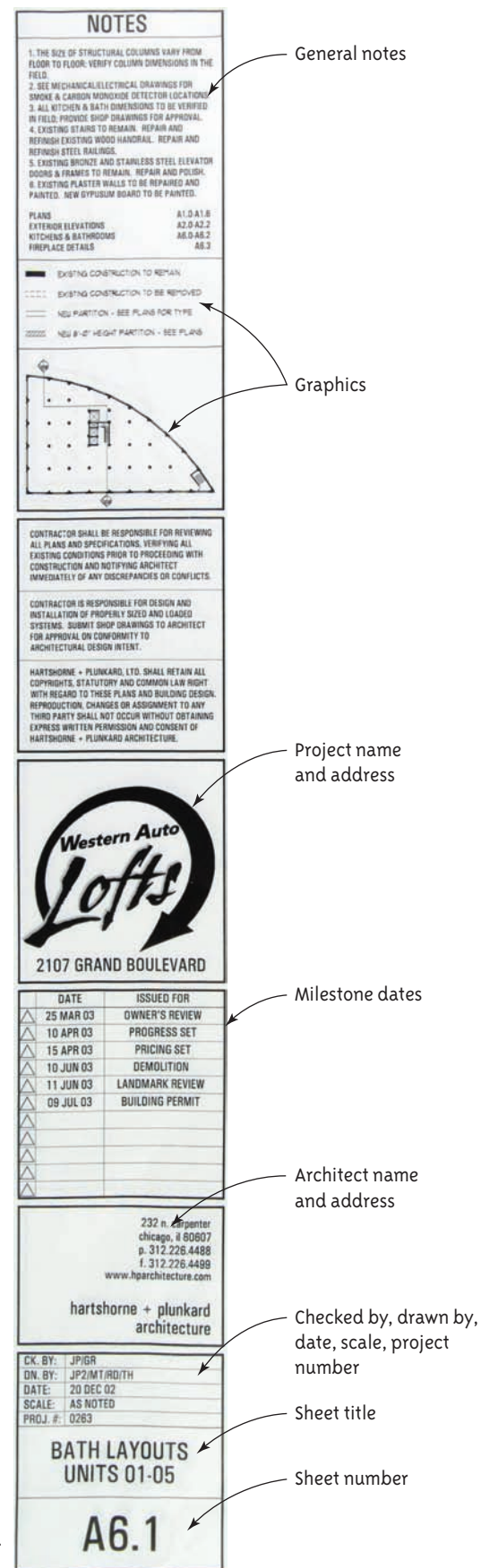
Title Blocks

Title blocks are square or rectangular boxes. They are typically placed vertically along the right side, in which case they are called title strips (Figure 3-23) or in the sheet's lower right-hand corner (Figure 3-24). Drawings are stapled on the left. Different construction disciplines often use different formats. However, title blocks are always put on each sheet and contain information about the project in general and the sheet in particular. Typical information includes the project title, sheet title, client name and address, architect/consultant contact information, revision dates, professional seal, scale, and date.

Sheet Composition

A simple project might consist of one centered drawing and ID label and a title block, as in the student assignment in Figure 3-25. Steps for centering one drawing are shown in Figures 3-27 and 3-28. In a commercial project sheets are often gridded into modules (with reproducible or nonreproducible lines) with one drawing placed in each module (Figure 3-26). This is

Figure 3-23
Title block on a professional drawing. It runs lengthwise on the right side of the sheet and contains detailed information about the project.
Courtesy of h+p architecture, Chicago, IL.



SCALE	APPROVED BY	DRAWN BY
DATE		
		DRAWING NUMBER

Figure 3-24
Generic title block. It goes in the lower right corner of the sheet.

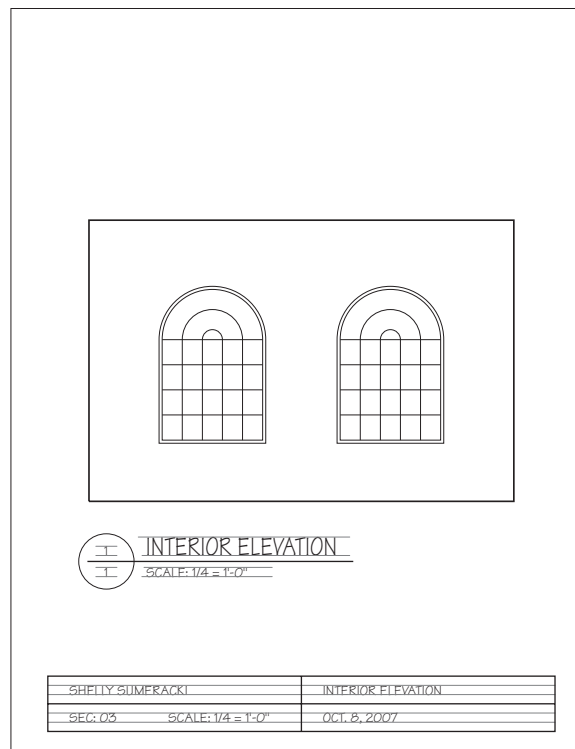


Figure 3-25
Student drawing of an interior elevation. The sheet is size A ($8\frac{1}{2}" \times 11"$). The title block is $\frac{1}{2}"$ from the bottom. Whether the sheet is oriented vertically or horizontally, a long title block like this should be placed on the short end. The picture is centered in the space above the title block.

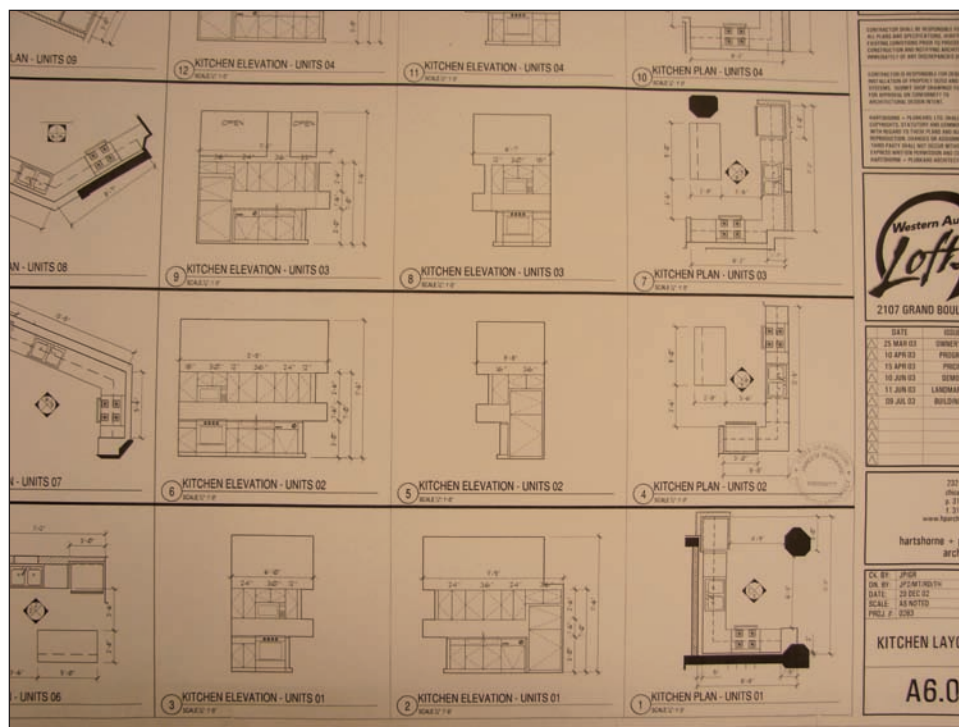


Figure 3-26
A commercial project laid out in gridded-box format. Drawing courtesy of h+p architecture, Chicago, IL.

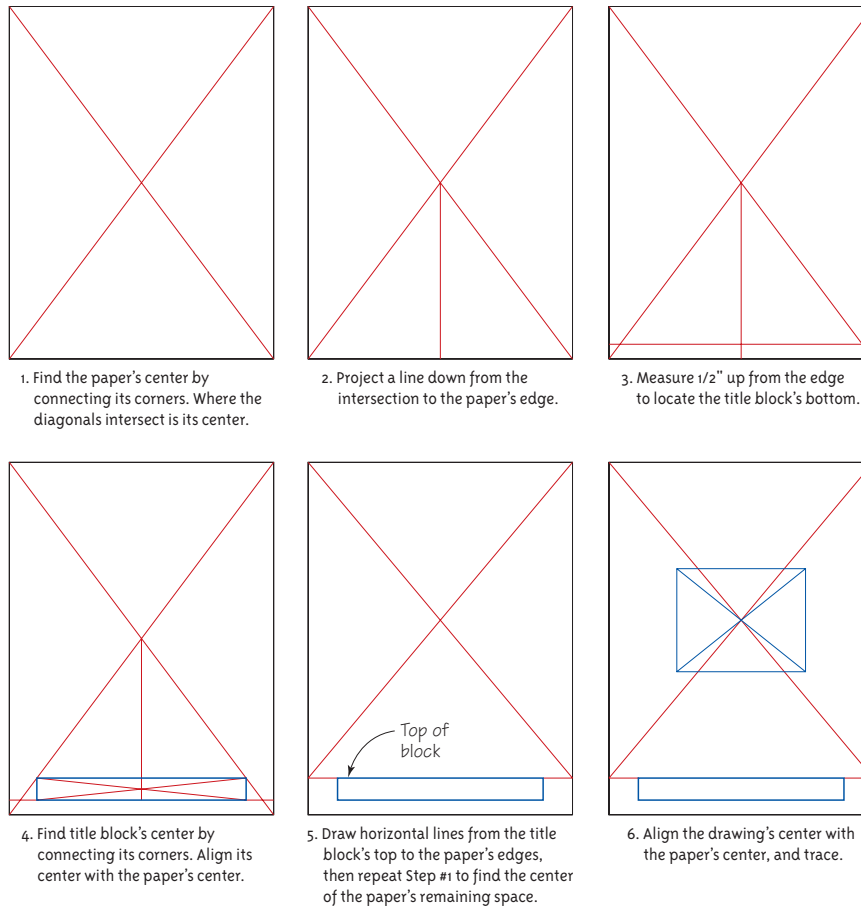


Figure 3-27
Steps for centering a drawing on a sheet.

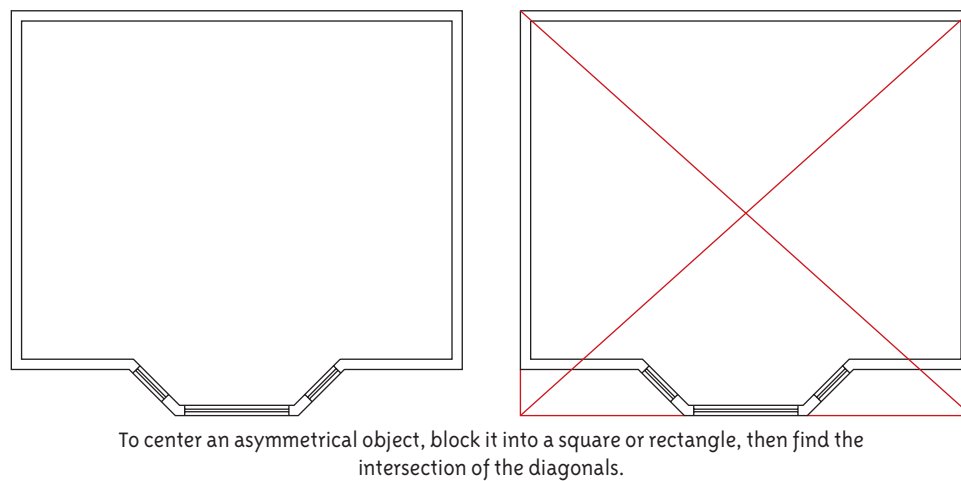


Figure 3-28
Steps for finding the center of an asymmetrical drawing.

so the structural grid or dimension lines on separate drawings won't overlap. Drawings are usually numbered from top to bottom and from left to right. On large, commercial projects, they are sometimes numbered from bottom to top and from right to left with any unused space at the left (stapled) side.

Multiple drawings on one sheet should be related, because this enhances comprehension. The most common combinations are plan/plan, elevation/section, elevation/plan, elevation/detail, and detail/detail. Avoid completing a partially filled sheet with drawings that don't reference or relate to the others.

On simple projects where there is just one drawing on one sheet, centering it makes a nice presentation. Figures 3-27 and 3-28 show steps centering a drawing and a title block.

Drawing Orientation

When possible, all plans should be drawn parallel to the edges of the paper, with north at the top of the sheet. This is called **plan north** and enables the drafter to give simple names to interior and exterior elevations. If plan north isn't compass (magnetic) north, an additional arrow is added to the drawing that points that way (Figure 3-29).

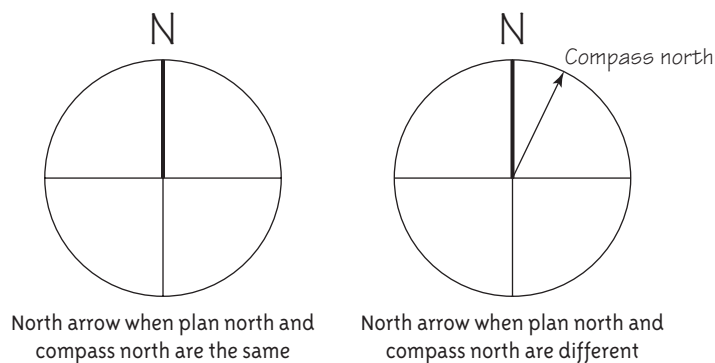


Figure 3-29
True north vs. compass north.

Lettering

Lettering is an aspect of note making. Notes are an integral part of a drawing and lettering's purpose is to make notes easy to read. Lettering is not the same as printing in capital letters, which doesn't provide the level of legibility needed for a set of construction drawings. Printed letters can get especially blurred when the drawings are printed half-size.

Look critically at the letters in Figure 3-30 to see what differentiates lettering from merely printing in capitals. Height is consistent, which is achieved by drawing guidelines (covered in Chapter 2). Letters are the entire height of the guidelines; they don't fall short. They may extend a bit above or below them; this is the case with certain styles and with fractions (fractions are drawn slightly larger than whole numbers). There are no gaps between the pencil lines. Spacing is consistent between words and within words. All same-type letters should look identical. Vertical strokes should be vertical, horizontal strokes should be horizontal, and angled strokes should all angle to the same degree. Numbers must match the style of letters.

Style

There are many different lettering styles, but only a few are suitable for architectural drafting. Avoid fancy styles, as they do not facilitate reading and are difficult to execute. While personalized styles were once a drafter's hallmark, CAD has virtually eliminated this practice. Designers now choose among different computer fonts; "City Blueprint" is one popular choice. For manual drafting, a simple block lettering style with horizontal strokes slightly angled is favored by many designers.

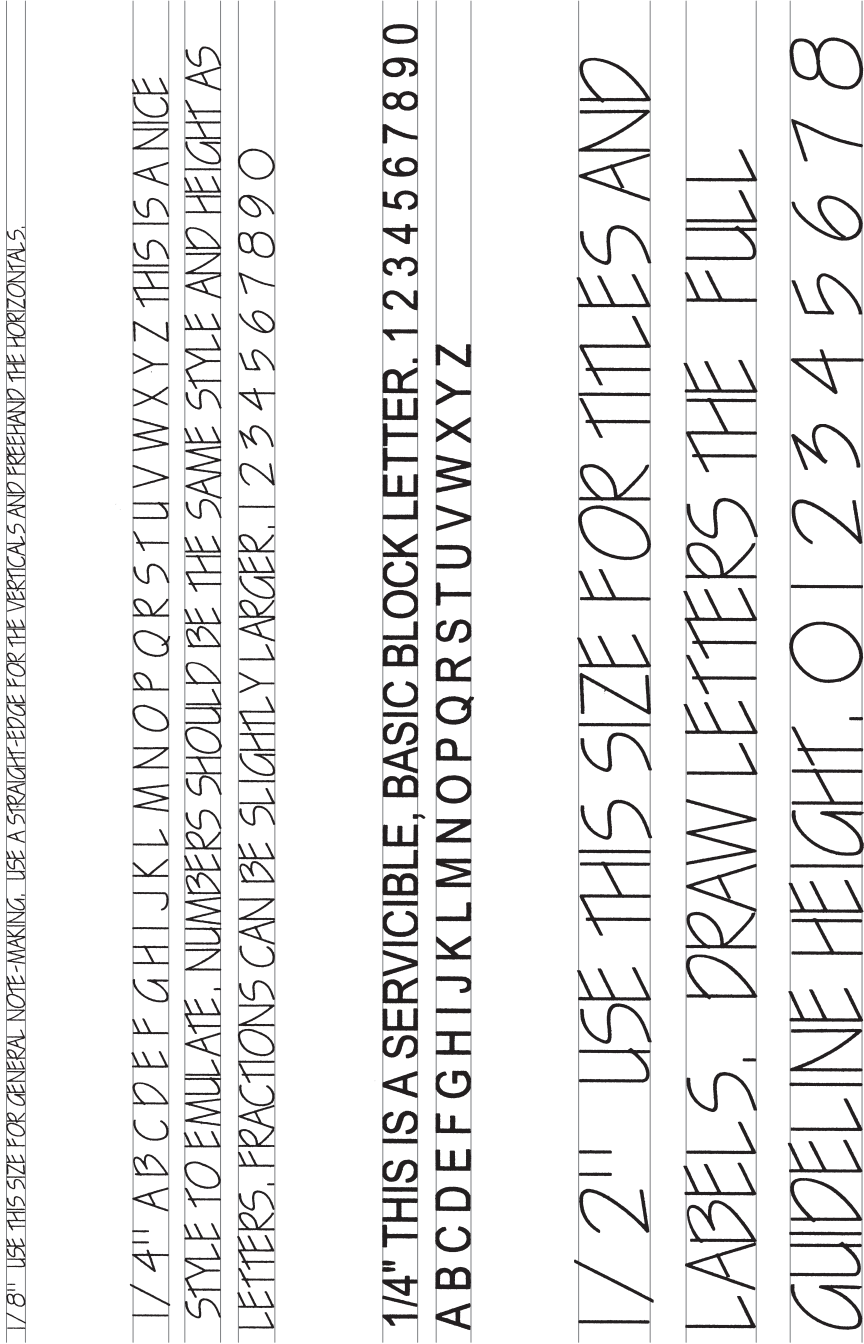


Figure 3-30
Architectural lettering. Two styles are shown: the basic block and a variant of the basic block (slanted horizontals). Either is appropriate for manual drafting.

Technique

A drafting pencil and a vertical straightedge (such as that of a small triangle or lettering guide) can be efficiently used to create letters (Figure 3-31). Slide the triangle or guide along the parallel bar to create vertical strokes and freehand the others. While using a straightedge is slow going at first, with practice you'll draw letters almost as fast as you can handwrite. Practice drawing words and sentences, rather than the alphabet, because words and phrases will incorporate spacing. Make the strokes quickly; slow, labored-over strokes look shaky. Rotate the pencil while drawing to obtain slightly different line weights. If smudging is a problem, use a harder lead or keep a clean sheet of paper under your hand to protect the letters already drawn. When inking, use a 0.40 mm pen. Most notes are made with 1/8" tall letters. Drawing titles are done with 1/4" letters. Only one lettering style should be used throughout a project.

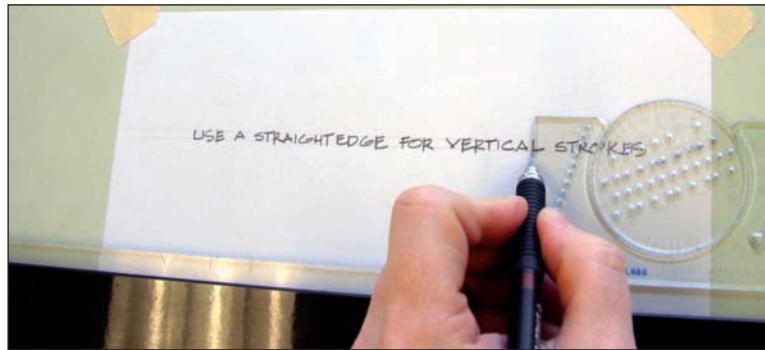


Figure 3-31
A small triangle or the Ames Lettering Guide provides a straightedge for lettering.

Mechanicals

Transfer letters (rub-ons), templates, and lettering wheels are alternatives to hand lettering (Figure 3-32). Rub-ons are bought in sheets, positioned in place, and rubbed with a burnishing tool. Templates are letter outlines that are positioned and traced. Lettering wheels are keyboard machines that print typed notes onto transparent tape. While these all may produce a nicer product than manual lettering does, they are also expensive and time consuming. Hence, they are best used as a supplement to produce larger letters, such as those in titles, which may be more difficult to draw.



Figure 3-32
Using mechanical aids in lieu of hand lettering. Pictured are rub-ons, templates, and a tool for drawing guidelines.

Notes

Notes are lettered comments placed on the drawings. There are general notes, which apply to the whole sheet or set, and local notes, which have a leader line pointing to the feature discussed (Figure 3-33). Notes describe specific features and also clarify intent, such as “slope floor to drain.” Here are some tips for their placement.

1. Notes can be placed between dimension lines and object lines. Arrange notes at the same time as dimension lines so they don't overlap. Avoid long leader lines between notes and the items they point to.
2. Group the notes around the construction they refer to. For instance, in a wall section, place all notes that refer to the floor slab in one general area close to that slab. Notes that apply to other areas should be placed elsewhere. Place notes as close to the items they point to as possible; for example, the topmost note directed to the floor slab should describe the topmost material in the floor slab construction, and so on. This will avoid crossed leader lines.
3. Align notes at the left; an even margin improves readability.

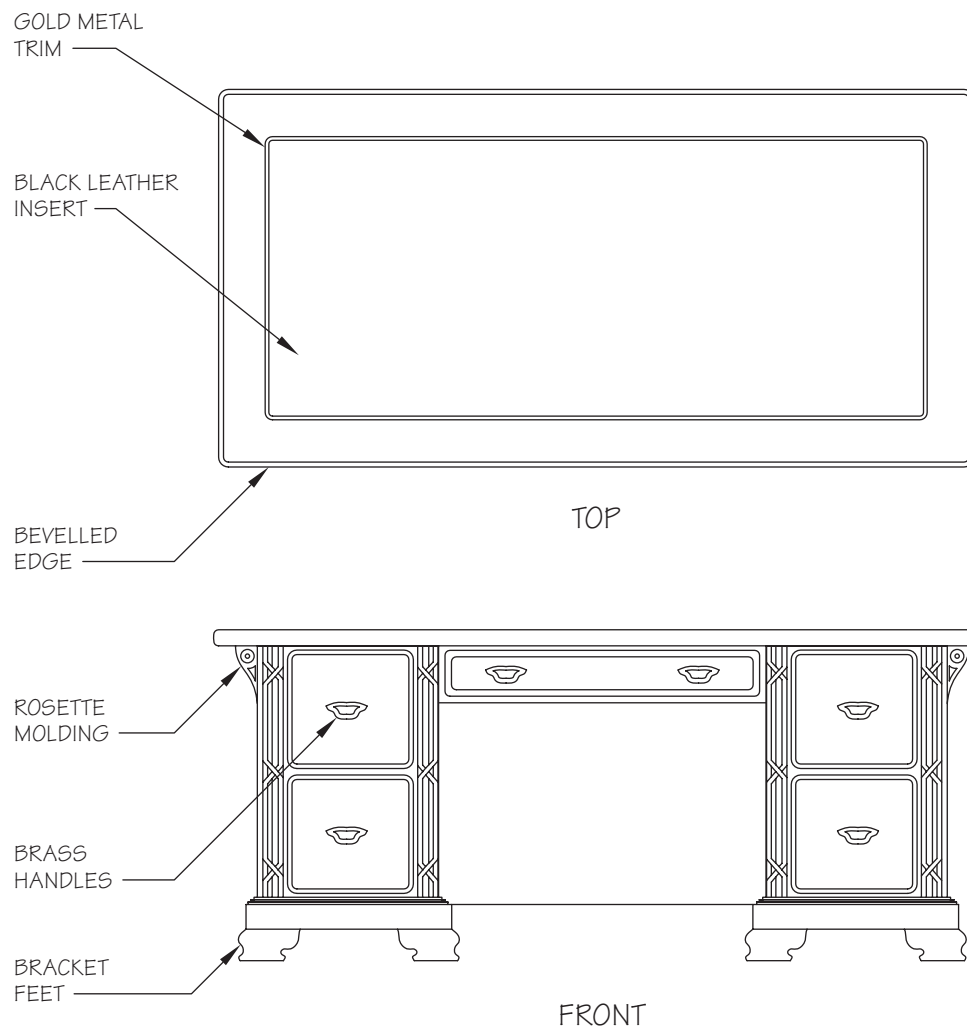


Figure 3-33
Well-placed notes and leader lines on a furniture drawing.

4. Draw leader lines at an angle to avoid confusion of leader lines with the drawing's vertical and horizontal lines. They may also be drawn with an irregular curve.
5. Start leader lines at the beginning or end of the note, not in the center. They should touch the material they're referring to.
6. Notes should be short and to the point. Nomenclature should be consistent throughout the set of drawings.

Summary

The complexity of architectural drawings is managed by using industry standards. Drafters must understand lines, symbols, and the concepts behind those symbols. No matter what part a person plays in the project, it's necessary to understand everyone else's part. If an interior designer has control of a project, such as a residential bath or kitchen redesign, he or she needs to understand the content of consultant submissions to check their overall compliance with the design intent.

Suggested Activities

Obtain sets of working drawings from different sources. Then:

1. Find and identify different line types and symbols on each set
2. Compare how the same symbols are drawn on different sets.
3. Find five objects (e.g., doors, cabinets) on each set and describe the line types used to draw them.
4. Write a list of the similarities and differences between section and elevation drawings.
5. Find and read the general notes. Discuss their relationship to the drawings.

Questions

1. What is the difference between a visible object line and a hidden object line?
2. Why are different line weights used on a drawing?
3. What is the purpose of general notes, local notes, and dimensions?
4. How should drawings be arranged on a sheet?
5. What is the purpose of a title block?
6. Explain how an elevation symbol and a drawing ID label are related to each other.

Further Reading and Internet Resources

Sutherland, M. (1989). *Lettering for Architects and Designers* (2nd ed.) New York: Van Nostrand Reinhold

<http://www.csinet.org>

Construction Specification Institute website. The Uniform Drawing System (UDS) conventions are among the information you can find here